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THERAPY

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LIFE IN MOTION

"First move well, then move often."
Gray Cook, 2010

FOREWORD

Quality over quantity?

Dear readers,

What is more important, quality or quantity? It depends! The saying goes: quality over quantity. In the context of rehabilitation too, we need to understand when and where quantity or quality is important.

Modern, evidence-based therapy values the quantity-over-quality approach, especially for functional restoration. It has been demonstrated, for example, that stroke patients who want to regain their mobility (quality-based) need to exercise a great deal (quantity-based). "Repetition matters!" Quantity (here: frequency of repetition) results in more quality in the movement.

But, as is so often the case, both aspects of quality and quantity are mutually dependent, like day and night. Martin Huber has taken a closer look at this here. In the editorial, he reports on the current state of research and provides a critical view of the role that movement quality plays in relearning motor tasks.

This issue also includes exciting practical and case examples from neurorehabilitation. Another certain highlight is the expert interview with Sarah Daniel from the UK, with an impressive report on the use of modern gait rehabilitation in ambulant physiotherapy. The interview is also available as a video to accompany the article.

I hope you enjoy this edition.

Jakob Tiebel

Contact the editorial team: therapy@thera-trainer.com
(tell us what you think!)

Intensive gait rehabilitation

Early mobilisation in the intensive care unit

Family values at the heart of global rehab robotics

Music feedback improves physical endurance

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Science

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SCIENCE

Hello Again!? The renaissance of movement quality

Recently, in the context of modern, evidence-based neurorehabilitation, the question of movement quality was (once again) raised. But wasn't this issue put to bed long ago?

Martin Huber

Consideration of quality of movement seems almost anachronistic. Movement quality has always played a major role in so-called empirical treatment approaches (mainly the Bobath concept) and continues to do so today [1]. In the context of modern evidence-based therapy, however, it has taken more of a backseat thus far. This is because modern motor neurorehabilitation primarily focuses on target achievement – and therefore on achieving a functional outcome – and not on the way in which patients move or how they achieve a movement target [2]. Movement quality has therefore been considered a secondary treatment and research target, and compensation has been seen as the best possible way to control remaining movement after CNS damage [3]. But now, publications by reputable and internationally renowned neuroscientists are causing a renaissance in the study of movement quality. A working group (Stroke Recovery and Rehabilitation Roundtable, SRRR) led by Gert Kwakkel, Carolee Winstein, John Krakauer and others is providing a major impetus for this [4].

What has led to the renewed interest in movement quality?

Movement quality matters to SRRR researchers and others because it enables a distinction to be made between true recovery (restitution) and compensation. The question is therefore: what exactly makes stroke patients better as the disease progresses? The recovery of the nervous system (true recovery, restitution) and the regaining of physiological movement patterns, or alternative movement patterns (compensations) being trained and established [5]? Or a combination of both? Neuroplasticity plays a key role in recovery after a brain injury. It forms the basis for restitution as well as compensation. The central nervous system reacts to damage (e.g. stroke) with plastic changes. These can be adaptive ("favourable, good" plasticity) or maladaptive ("unfavourable, bad" plasticity) [7]. The former are spontaneous biological processes (reversal of diaschisis, regression of penumbra) which help with functional recovery, while the latter are learning- or experience-dependent processes. The learning- and experience-dependent mechanisms lead to structural (dendritic and axonal sprouting, cortical remapping, etc.) and functional changes (long-term potentiation) to the nervous system [6]. These learning- and experience-dependent forms of neuroplasticity (use-dependent plasticity, exercise-induced plasticity, guided recovery) are highly relevant when considering movement quality. This is because neuroplastic changes are not the result of automatic, untargeted and unalterable processes. Quite the opposite. Plasticity is stimulus-dependent and is ultimately the result of the repetition of certain movement patterns. Frequently repeated movement patterns are stored as a priority (Hebbian plasticity). This is the case with physiological movement patterns and less physiological movement patterns (compensation) alike. Compensatory movement patterns are considered a factor for maladaptive neuroplastic adjustments [6][8]. The "how" of movement control therefore also influences the type of neuroplasticity (adaptive or maladaptive).

Movement quality as the focus of training the upper limbs

The SRRR dealt with movement quality as part of the rehabilitation of the upper limbs. Here, it is mainly John Krakauer who has attracted attention with his recent research work and notable theses [8]. According to one of these theses, a "non-task-oriented approach may be more fruitful for recovery from motor impairment" than the widespread task-oriented therapy approach [9]. Krakauer goes even further to say: "the focus of training should be on movement quality rather than task accomplishment" [9]. His statements are based on the circumstances that neuroplasticity is stimulus-dependent and can therefore be influenced. And that the pathological movement patterns of the upper limbs (flexor synergy) are also alterable and are not exactly the best possible remaining type of movement control. They are merely the easiest way for the damaged nervous system to recall movements. This form of movement control is in no way an inevitable fate, but can be influenced in the sense of increased movement quality [10–12].

Lower limb recovery (standing, walking)

In a similar way to the upper limbs, improvements on the activity level here (walking speed, walking endurance) are not necessarily the result of actual restitution, but are often based on the learning of "effective" compensation strategies [13][14].

In everyday clinical practice, typical compensations can be observed: reduced transfer of weight in the supporting leg phase on the paretic side, knee hyperextension in the supporting leg phase on the paretic side, circumduction in the swing phase on the paretic side, extended standing phase on both legs, asymmetric movement pattern etc. The positive influence of movement quality may therefore enable the use of adaptive forms of neuroplasticity. Various studies give indications of this [15–16].

Routson and colleagues [16] investigated the effect of treadmill exercise manually supported by therapists in stroke patients. They reached the conclusion that this training "has the potential to influence [...] timing quality, which can lead to improvements in symmetry". The manual assistance used was designed to positively influence the desired movements of the trunk and lower limbs during walking, as well as temporal and spatial movement patterns.

However, the authors of the study point out that the effect of the therapy depended on the severity of the deficits. It appears sensible to observe and treat movement quality in an appropriate manner during rehabilitation of the lower limbs (walking). For this reason, Clare Maguire [17] points out that interventions which "facilitate the selective activation of muscle synergies during walking" should be used. For example, through targeted gait training with and without equipment, where the kinematic movement performance is influenced and physiological movement patterns are practised. This prevents the use of compensatory movement strategies, which in turn can help with the recovery of pre-morbid movement patterns [17].

Conclusion

Addressing movement quality has returned to the spotlight of motor neurorehabilitation as a relevant topic. There are no one-size-fits-all solutions to this problem. The role of movement quality and compensation should rather be assessed in a very differentiated and individualised manner. On the one hand, not all patients have the same potential for change and recovery. And on the other hand, research is definitely still needed to develop and evaluate future treatment strategies. Regarding the above factor of potential for change, Robertson [18] claims that patients can fall into three subgroups:

1. Patients with spontaneous recovery (slight damage to the nervous system)
2. Patients with guided recovery* (moderate damage to the nervous system) *use-dependent plasticity, learning-dependent plasticity, exercise-induced plasticity
3. Patients with no or very low recovery (severe damage to the nervous system)

For patients from subgroup 2, therapy that takes into account movement quality is sensible. For those from subgroup 3, therapy that allows for or even trains compensations is suitable. That is to say, some patients benefit from a treatment approach tailored to recovery (movement quality) and others from a compensation-based approach [13].

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Martin Huber Physiotherapist and Master of Science in Neurorehabilitation

TECHNOLOGY & DEVELOPMENT

Family values at the heart of global rehab robotics

As one of the early pioneers in the field of rehab tech, THERA-Trainer continues to expand internationally on the strength of the expertise and reputation it has built over the past 32 years. We meet CEO Dr. Jonathan Kopf, who discusses his pride at being at the helm of one of the last family-owned companies in the fast-growing sector.

NR Times

"I don't think my father ever really thought of the scale we'd be working on as a business, more than 30 years later. His aim was to do rehabilitation better using technology and to help people live their lives." And from the creation of the first device in 1990 to enable wider access to tech-led rehab – then in its infancy as an industry – Peter Kopf lay the foundations of THERA-Trainer, now a globally successful business and pioneer in rehabilitation robotics. With an array of products for lower limb rehabilitation – all of which are designed and manufactured in-house at its base in Southern Germany – now in use in 70 countries internationally, THERA-Trainer is also making waves around the world with its Complete Solution, a specially-devised and evidence-based treatment programme which is consistently delivering positive outcomes in gait improvement. Regarded as one of the leaders in the fast-developing rehab tech sector, THERA-Trainer remains distinct from

its competitors as one of the last family-owned companies, now being run by the second generation of the Kopf family, with Peter's son, Dr Jonathan Kopf, taking the reins as CEO and overseeing its ongoing expansion. And it is both its product suite – which is set to see new additions in the near future – and its family business ethos, which is at the heart of the trusting relationships it builds with clients worldwide, which Dr Kopf believes are crucial to THERA-Trainer's growth. The latest step in that journey saw it establish a UK base through the acquisition of Medicotech. "Since my father made the first prototype in 1990, we have had the values of 'safe, easy, effective and affordable'. I think particularly easy and affordable stand out in the industry today," says Dr Kopf, who joined the family business after almost a decade at McKinsey.

"We're proud to have the easiest to use robotic devices in the market. We believe that technology should make a therapist's life easier, not more complicated. So designing our devices to be as easy to use and quick to setup as possible is one of our core goals and achievements. And while we produce very high quality, premium robotic solutions, we try to sell them to hospitals at an affordable price that allows many of them to acquire our technology. For the cost of a single exoskeleton, you can buy our Complete Solution, covering the entire continuum of therapy. My father was motivated by bringing better equipment to the industry and to the people who need it, and that remains central to what we do. For us, the proudest moments are when patients are able to celebrate a milestone. We have people who are training in our THERA-Trainer lyra who haven't walked for so long, and then they discover how it feels to walk again. Seeing their joy and knowing what that means to them is what it's about. Having been one of the early

For us, the proudest moments are when patients are able to celebrate a milestone.

major players in the rehab tech market, THERA-Trainer is uniquely placed to see how the industry has developed around it. I think looking at the industry, there are a few companies who shaped the industry landscape that we see today," says Dr Kopf. "We are innovators coming from sensor-based cycling and balancing technology with a much broader robotics portfolio than we did at the start, but it's not us alone – other companies have, for example, successfully pioneered exoskeletons. Back then, it was very different being a pioneer, it was the whole concept of being a self-made businessman rather than a situation where you get millions of dollars from investors which you can then invest in research and development as well as marketing. Instead, you had to have a sustainable business model, everything comes from your own pocket. Nowadays, it does feel quite unique to be a family company, where the family is hands-on and has been for over 30 years. We have built up the business ourselves, but now the field is much more crowded. It's to the benefit of every patient if there are more solutions out there for them. And the further we push robotics in rehabilitation as an industry combined, the more we can achieve for the patients." In delivering that, the ongoing expansion of THERA-Trainer continues at pace, but for the past few years has focused particularly on key markets like the US, UK, France and its native Germany, where it is proud to be headquartered and call home to its 130-strong team.

Its presence in the UK was bolstered recently with the creation of a dedicated UK division through the acquisition of Medicotech, a longstanding partner of THERA-Trainer. "We have realised that for some markets, it's very important to be there directly, instead of only going through partners," says Dr Kopf. "We have countries around the world that we're selling to with partners, and generally that works really well. But there are some markets where you simply feel like the potential is much higher, if you can actually go there yourself and offer the entire portfolio to the market directly, then that serves both us and the customers in these markets. I think that is important in building a brand in a significant market, that the relevant people get to know you and the business and probably see for themselves the big difference between you and other competitors who exist. We have worked in the UK for many years and been very successful, but that is why we took that step (in acquiring Medicotech). That got us to the point to actually say this is a really important core market that we want to dedicate our attention to. I believe that our growth will accelerate in the years ahead as a result. By building subsidiaries, and creating the accompanying brand recognition and trust, the increasingly international THERA-Trainer business remains proudly based in Germany. Being a family-owned company means our family name is tied to the brand, which means the quality we provide is extremely important to us. Everything

Being a family-owned company means our family name is tied to the brand, which means the quality we provide is extremely important to us. Everything is made in Germany, and will continue to be so

is made in Germany, and will continue to be so," says Dr Kopf. "This makes it more challenging to compete with companies producing in low cost countries. But we believe customers value the quality of 'Made in Germany' and we're ensuring through efficient production processes to make this quality level 'affordable' to clinicians and patients. We collaborate with universities and researchers across the world and, for example, also have a think tank with brilliant researchers in Slovenia for early stage research and prototyping – but our core is in Southern Germany and will continue to stay here in the future."

While the world has changed significantly since the inception of THERA-Trainer – not least in terms of the rise of rehab robotics and the sizeable investment that can attract – Dr Kopf is committed to ensuring the business stays true to its independent roots. "We have some exciting product launches this year and next, and we will be building upon our THERA-Soft software solution to improve that and bring even more into it," says Dr Kopf. "Amongst others, we're researching into artificial intelligence, virtual reality and augmented reality, and I think there are a lot of very, very interesting directions to come in the next few years, some very positive changes. But one thing that won't change is that we will stay a family-owned business. It's always sad to see competitors who have really good products get sold, and then resold, and you see how things often decline. We want to stay as a long-term reliable partner, which means we need to continue with our sustainable business model. So I don't think we'll join the race for acquiring lots of investment – we want to stay independent. That, I firmly believe, is the best way not only for us, but for our partners and all of those who need it most."

The management of THERA-Trainer (from left to right) Otto Höbel (CTO), Dr. Jonathan Kopf (CEO) and Peter Kopf (Founder and CEO).

We were there!

Cognitive-motor training in neurorehabilitation

Effects of a research-based exergame training on motor and cognitive functions in patients with neurological diseases

Specific physical and cognitive training has been shown to have a positive effect on certain symptoms, such as impaired voluntary movement, balance and focus of attention. Thus, rehabilitation has a significant impact on the quality of life of neurological patients. A novel form of training – exergaming – combines cognitive and motor training elements with digital game play. For this purpose, game-based training programs are presented on a screen, which are controlled by specific body movements on a reactive ground plate. Depending on the training focus, different mental (e.g. reaction, inhibition) and physical (e.g. balance, coordination) functions are addressed. By linking the cognitive and motor performance elements, this combined form of training comes very close to the demands and sequences of everyday activities. These synergy effects can be exploited and functions relevant to everyday life can be specifically improved. In addition, the playful component increases the fun factor, which positively influences training motivation and adherence. Exergames thus represent a challenging and varied extension to conventional exercise therapy. Due to the high effectiveness of the intervention, there is great potential for neurorehabilitation, especially with regard to the recovery of motor functions, standing, walking and prevention. Using the example of the THERA-Trainer senso, a research-based training system for cognitive-motor training, this lecture critically reflected on the mechanisms of operation and effects of this therapeutic program in the context of evidence-based practice in neurorehabilitation.

Review WCNR Vienna

14. – 17. Dezember 2022

THERA-Trainer Speaker:
Dr. Sc. Manuela Adcock

Manuela is a neurop sychologist with years of clinical experience at the University Hospital Zurich. As a neuroscientist, her PhD explored the relationship between technology-based cognitive-motor training and physical as well as cognitive functions and neuroplasticity. Her main interest is the cognitive-motor interplay. Manuela Adcock is Head of Research at Dividat AG – a spin-off company of ETH Zurich with the main focus on promoting health and independence at all stages of life with technology-based training concepts and systems.

https://lp.thera-trainer.com/thera-trainer-senso/senso-wcnr-2/

Back to the future

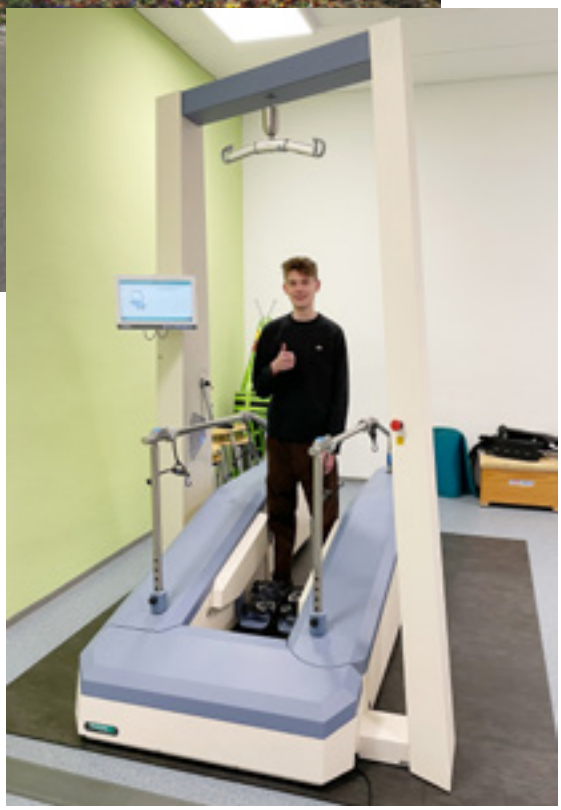
At the age of just 19, Hannes' life as he had known it was literally thrown off course. The athletic young man from Oberschwaben started up his motorbike in July 2021 and then, in just the blink of an eye, found himself waking up after spending more than two weeks in a coma in the intensive care unit. Without any kind of memory of what had happened.

Daniel Heß

Hannes described waking up as indescribably frightening and absolutely surreal. He felt like he was awake and in a nightmare at the same time. Several days passed before he realised that he was in the intensive care unit of the Kliniken Schmieder in Allensbach. The bitter diagnosis: crushed lungs, splintered cervical vertebrae, fractured thoracic vertebrae and femurs, pneumonia and artificial feeding. It was his family who told him about the motorbike accident and that he had been brought to the University Hospital of Ulm by helicopter. He must have skidded out of the bend.

After Hannes was able to move from the intensive care unit to the normal ward, he had another stay at Klinikum Singen and then arrived at out-patient rehabilitation in the Schlossklinik in Bad Buchau in December.

There, while still severely weakened and in extreme pain, he started his first exercises in September/ October 2021, such as sitting at the edge of the bed or standing up with the help of a therapist. At that time, Hannes had been in the middle of his vocational training, was a passionate football and tennis player, and spent a lot of time out and about with his friends. And now he was practising how to sit. Despite everything, he did not lose heart, in part thanks to his family who stuck by him on this tough journey at all times.



After he was able to sit and take his first cautious steps using a walking frame, Hannes began training with the THERA-Trainer lyra, an end-effector gait trainer for intense training at performance limits which imitates the human gait pattern perfectly. The lyra enables patients to make up to 20 times as many repetitions as treadmill-based or manual gait training.

And the extreme efforts paid off. Hannes quickly made progress, experiencing less pain and able to walk for longer after every session with the THERA-Trainer lyra. He gradually fought his way "back to the future". When our THERA-Trainer team met Hannes at the end of January 2022 during out-patient rehabilitation (still 5 days a week) at the Schlossklinik in Bad Buchau, the now 20-year-old was already walking 4 to 5 km a day! His endless discipline and the optimal treatment by all the medical professionals in the clinics he went through all contributed to this success.

Hannes is able to continue his vocational training. Driving, working out and tennis are also back on the daily agenda once again. He even no longer has to take medication. But he never wants to ride a motorbike again.

SCIENCE

A comparison of the best end-effector gait trainers

There are various ways to relearn how to walk following a stroke using robotics devices. In everyday clinical practice, exoskeleton-supported (e.g. Lokomat) and end-effector-based gait trainers (e.g. THERA-Trainer lyra) are mainly used. Treadmills are used with and without weight relief in the later phase. But which therapy is the most effective for improving walking?

Jakob Tiebel

To answer this question, researchers conducted a systematic review of randomised controlled trials with network meta-analysis. Indirect comparisons and network meta-analyses represent a key evolution of traditional meta-analyses. The primary endpoint was walking speed, while the secondary endpoints were walking ability, gait endurance and gait stability. No gait training or conventional gait training served as the reference category. This was contrasted with treadmill training with or without bodyweight relief, treadmill training with and without a speed paradigm, and electromechanically-assisted gait training with end-effector and exoskeleton devices. The systematic search resulted in 40,567 hits. The evaluation included 95 randomised controlled trials with a total of 4,458 patients after a stroke. For the primary endpoint of walking speed, significant improvements were

achieved through gait training with end-effector-assisted devices (MD = 0.16 m/s; 95% CI = 0.04–0.28). None of the other interventions improved walking speed significantly. For the secondary endpoint of gait endurance, end-effector-assisted gait training and treadmill training with bodyweight relief showed a significant improvement (MD = 47 m, CI: 4-90 and MD = 38 m, CI 4-72, respectively). No network meta-analysis was performed for the secondary endpoint of walking ability due to significant inconsistencies. No difference was identified between the safety of the individual interventions.

Compared to conventional gait rehabilitation, treadmill therapy with partial bodyweight relief achieves significant and clinically significant improvements in gait endurance compared to conventional therapy.

Comments:
A highly interesting study with unexpected results! The title of the publication was later criticised as being misleading.

Walking speed had been chosen as the primary endpoint. The title is "The Improvement of Walking Ability Following Stroke". Actually, the parameters of walking ability, walking speed, walking distance and steadiness have to be differentiated. Whether this was an oversight remains unclear.

But it changes nothing about the quality and significance of the results. The end effector also remains the method of choice for regaining walking ability, as demonstrated by current meta-analyses and guidelines.

The researchers come to the conclusion that, compared to conventional gait rehabilitation, end-effector-assisted gait training in particular significantly and clinically improves gait speed and gait endurance following a stroke.

LITERATURE:
Mehrholz J, Pohl M, Kugler J, Elsner B. (2018). The Improvement of Walking Ability Following Stroke. Deutsches Ärzteblatt International, 28 September 2018; 115(39):639-645. doi: 10.3238/arztebl.2018.0639. PubMed PMID: 30375325; PubMed Central PMCID: PMC6224539.

Jakob Tiebel studied Applied Psychology with a focus on Healthcare Managementand has gained clinical expertise through previous therapeutic work in neurorehabilitation. He researches and publishes on theory-practice transfer in neurorehabilitation and is the owner of Native.Health, a digital health marketing agency.

Can focusing on prevention be profitable?

A retirement home in Brunnadern has set itself the goal of providing greater quality of life and opening up a new source of income with prevention. Read the interview with Roman Strübi, Manager of the Liebenau Neckertal retirement home, about how the centre is successfully putting nursing training into practice.

Dividat interviews Roman Strübi

The Liebenau Neckertal retirement home in Brunnadern equipped four of the home's five residential groups with exercise equipment from Dividat worth CHF 90,000 in 2021. Residents are benefitting from greater independence and quality of life, and the home was able to recoup the cost of the equipment within a very short time. With this innovation, inpatient long-term care is providing a shining example of how a shift from care to prevention can be achieved. It also demonstrates how this can work economically and even generate additional income over a longer period of time. Home Manager Roman Strübi and Head of Nursing Miro Zuparic are thrilled:

"Right from the start, it was important for us to recoup the cost of the equipment and to promote the attractiveness of the home, along with the very positive effect for the residents (increasing and improving strength, coordination, balance, cognition, concentration, endurance, positive body awareness). Due to annual measurements and assessments of quality indicators, we had set ourselves the goal of reducing falls and promoting independent mobility. Both have improved significantly within a year."

Mr Strübi, we at Dividat have been campaigning for a long time for more relevance to be assigned to prevention. So far, however, it has often not been possible to implement a concept in such a way that it pays off economically. Can you explain to us how you achieved this?

Roman Strübi: At the start, it was no easy task for us, and we had to handle things in a highly structured way. The will of the staff to offer something special to the residents during the pandemic, as well as the location of the training equipment, which is at the heart of the action, played key roles in this success. It is a matter of see and be seen for the people, and now the training has become an integral part of the daily routine. We have managed to get about 50% of all residents using the Dividat exercise equipment, six times a week, sometimes even twice a day.

How can RAI/BESA be used to document training?

Roman Strübi: The Dividat Senso and the training equipment are excellent for use as long-term care training. In the RAI-NH Manual version 2.0 under 3.

Long-term care training, page 169, Appendix A MDS 01_2016, Initial Assessment page 13, the possibilities for documenting and billing the training via RAI are explained. Two long-term care training sessions per day (continence, toileting, mobility, training devices, etc.), at least six days per week, result in a level increase of 1–2 per resident. For refinancing, at least 1x Dividat and e.g. 1x toilet training per day are sufficient. This is brilliant and all in all, makes it a very worthwhile investment!

What does the documentation look like and what were the responses from health insurance providers/local councils?

Roman Strübi: The aims and measures in long-term care planning have to be comprehensible. Health insurers accepted the level increases after this review. It is also nice for the home to see the residents becoming easier to look after when they have more movement in general. Twice a year, an assessment is performed on all residents and the doctor signs off on the long-term care training. Our external physiotherapists with a doctor's prescription also use the equipment together with the residents.

Who carries out the training?

Roman Strübi: Planning the use of our training equipment is discussed internally with the kinesthetics supervisors. The training is accompanied by carers. However, this is not a problem for us because the devices are fully integrated into everyday life, i.e. 2-3 metres away for the carers. A central location is essential for a successful concept and contact persons need to be defined. There is a tendency to exercise more in the morning so that residents can participate in different activities spread throughout the day. One residential group has three different Dividat devices (THERA-Trainer, StepOne, Dividat Senso), while the other three residential groups each have one THERA-Trainer and one Dividat Senso, with a screen (Dividat Mile) always included in all residential groups. It is lovely to see the equipment being so well used.

Dividat is a spin-off company of ETH

The team combines expertise from the fields of movement science, neuroscience, neuropsychology and informatics to provide high-quality training and therapy concepts.

This knowledge is complemented by constant cooperation with leading international research institutions.

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Roman Strübi Manager of the Liebenau Neckertal retirement home

Stroke: What is the importance of continuity of rehabilitation in the restoration of motor function?

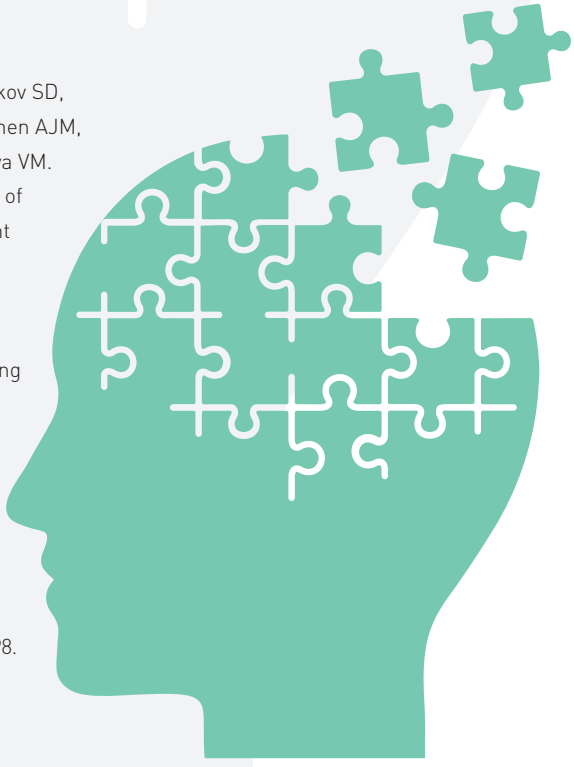
Motor recovery after a stroke is based on a restructuring of the brain.

Jakob Tiebel

There is much discussion about the right time to start rehabilitation in the acute phase of stroke, the importance of rehabilitation measures during the first three months and the advantages of modern versus traditional rehabilitation programmes. The aim of one study by Koroleva and colleagues was to assess the impact of different rehabilitation strategies and their combinations on functional disability three months after an ischaemic stroke.

The researchers used three rehabilitation approaches: early rehabilitation from the first day after the stroke (phase I), traditional exercise programmes (phase II) and a new method with biofeedback and movement sensors (phase III). The clinical and functional results were measured on the 90th day following the stroke. The authors were able to prove that while early rehabilitation is successful, it is not sufficient. Therapy must be continued throughout the "sensitive phase" after the stroke. Modern and traditional therapeutic approaches work best when combined.

ORIGINAL WORK:
Koroleva ES, Kazakov SD, Tolmachev IV, Loonen AJM, Ivanova SA, Alifirova VM. Clinical Evaluation of Different Treatment Strategies for Motor Recovery in Poststroke Rehabilitation during the First 90 Days. J Clin Med. 2021 Aug 21;10(16): 3718.doi: 10.3390 jcm10163718. PMID: 34442014; PMCID: PMC8396898.



State-of-the-art gait therapy at Schlossklinik Bad Buchau

For many patients at Schlossklinik Bad Buchau, walking is one of the most important goals after a serious neurological illness. Thanks to a regional cooperation with medica Medizintechnik GmbH from Hochdorf, patients and therapists have been benefitting from one of the most modern gait therapy devices for a few months now.

Jakob Tiebel

Schlossklinik Bad Buchau is located in the south of Germany in the immediate vicinity of THERA-Trainer's headquarters. The clinic is part of the Federsee Health Centre and specialises in the medical care of patients with neurological and psychosomatic diseases. The interdisciplinary treatment teams offer comprehensive support based on the latest findings in rehabilitation medicine. The Schlossklinik is also an academic teaching hospital of the University of Ulm and thus maintains close links with teaching and research. Thanks to a regional cooperation with THERA-Trainer, patients and therapists have been benefitting from one of the most modern rehabilitation technologies on the market, THERA-Trainer lyra, for a few months now.

The integration of the gait trainer into daily therapeutic routines was handled by the team of therapists, consisting of 13 physiotherapists and sports therapists. One major advantage of the THERA-Trainer lyra is that it allows you to get close to the patient to work with them even during the training. The uncomplicated barrier-free access has also met with praise. Therapy manager Anja Pohlschmidt sees numerous advantages compared to the previous gait trainer.

Feedback from patients who had previously trained with the older gait trainer and were then able to make a direct comparison is equally positive. One of the biggest advantages is that, unlike the predecessor device, treatment in the THERA-Trainer lyra is not restricted to more severely affected patients. The lyra is also ideal for more mobile patients, who are mainly focused on gait speed and a uniform step length, says Pohlschmidt. According to her, almost all patients in the clinic with neurological clinical pictures can use the lyra. They include many stroke and MS patients, as well as people with Parkinson's

disease or even ALS in its early stages. "On average, our patients are in the lyra about two to three times a week," explains Pohlschmidt. "As we have other training equipment in the same therapy room, where other patients are training at the same time, a small training group is formed in each therapy session, with each patient motivating the other," continues Pohlschmidt.

Clinic management and Dr Alexander Unrath, Chief Physician for Neurology at the Schlossklinik, are also very pleased with the new purchase. "The new equipment has enabled our therapists to work much more efficiently. Patients can be transferred from the wheelchair to the lyra quickly and easily, which was important to us as we can then use a large part of the therapy time for the therapy itself and not for any tedious preparations," says Dr Unrath. Anja Pohlschmidt sees another argument – motivation: "We are able to document each patient's training seamlessly. Since starting to work with the lyra, improvements in patient performance can therefore be proven to doctors and health insurance companies. And not only can we as therapists see the patients' progress, but it is also there in black and white for the patients themselves. For many, that's a major motivation to become even better!"

Schlossklinik Bad Buchau

The Schlossklinik in Bad Buchau is part of the "Gesundheitszentrum Federsee" (Federsee Health Centre) brand. This also includes the Federseeklinik, Adelindis Thermal Spa and "Gesundheits-Bad Buchau" Spa Hotel with spa centre and restaurant.

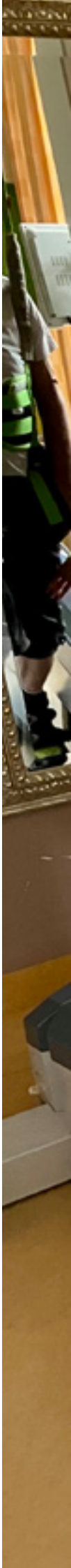
Further information is available online at **www.gzf.de**.

SCIENCE

Risk of falling – end-effector gait training after a stroke

Effects of end-effector training in relation to the risk of falling after a stroke.

Chiara Winter, Fresenius University, University of Applied Science



Background: Falling is a common complication after a stroke. The proportion of patients who fall increases to 23–45 per cent six months after the stroke occurs and 40–73 per cent after 1 to 2 years. This is usually because the body no longer possesses enough stability and balance and any correction or adaptation takes place too late or not at all. This means that it is important to detect potential fall risks at an early stage as part of the rehabilitation and performance of effective training. Research has already identified the positive effects of end-effector gait training on the improvement and restoration of walking ability after a stroke over the past years. The intensive, repetitive and task-oriented training stimulates the development of synapses and their connections. Frequent repetition also encourages motor learning.

Objective: The aim of this study was to examine the effects of end-effector gait training using the example of the THERA-Trainer lyra in relation to the risk of falling among stroke patients in order to determine whether the training can minimise the risk of falling. This would give patients the chance to lay the groundwork for greater independence and safety in everyday life during the rehabilitation phase and the training equipment would play an additional role in the effectiveness of fall prevention.

"End-effector training enables 1000 steps in one therapy session, compared to 100 steps per session with conventional gait training."

Methodology: As part of a randomised, controlled study, 16 patients were recruited from a rehabilitation facility and allocated to an intervention and control group at random. Both groups received six therapy applications, each lasting thirty minutes, over a three-week intervention period. The intervention group conducted end-effector gait training and the control group conventional gait training. Pre-testing and post-testing were carried out to investigate the risk of falling. The Timed Up and Go, Berg Balance Scale and Short Falls Efficacy Scale International were the assessments used.

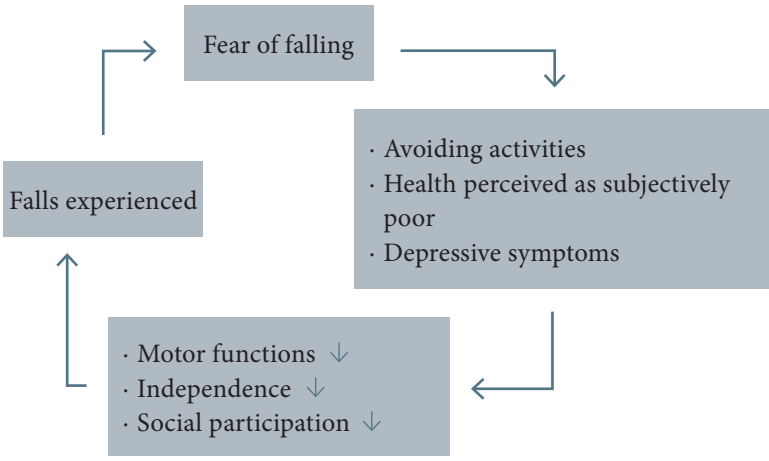
Results: Improvements were able to be recorded for all assessments in both groups, with the improvements in the intervention group each higher than those of the control group. The results of the Timed Up and Go improved by an average of 29.2% in the intervention group. In the Berg Balance Scale, an improvement of 21.1% of average values in the intervention group was achieved and the Short Falls Efficacy Scale International showed a percentage-based improvement of 19.8% for patients. For the intervention group, significant results were obtained in the intragroup comparison for the Timed Up and Go ($p = .045$), the BBS ($p = .003$) and the Short Falls Efficacy Scale International ($p = .008$) and in the intergroup comparison for the Short Falls Efficacy Scale International ($p = .047$).

Conclusion: The results of the investigation show that a statistically significant improvement could be demonstrated through end-effector gait training in patients after a stroke using the TUG, BBS and Short FES-I. A positive correlation of the end-effector gait training on the risk of falling can be assumed due to stronger improvements in the intervention group compared to the control group, despite incomplete, significantly statistical results. Greater improvements in the intervention group over the control group could be attributed to the much higher number of step repetitions that the patients in the intervention group could achieve.

It can be assumed that the patients in the intervention group were able to achieve greater progress in relearning motor functions through repetitive training.

More concrete statements on this issue require further research, including a larger sample and follow-up investigation.

Fig. 1: Vicious circle – Fear of falling

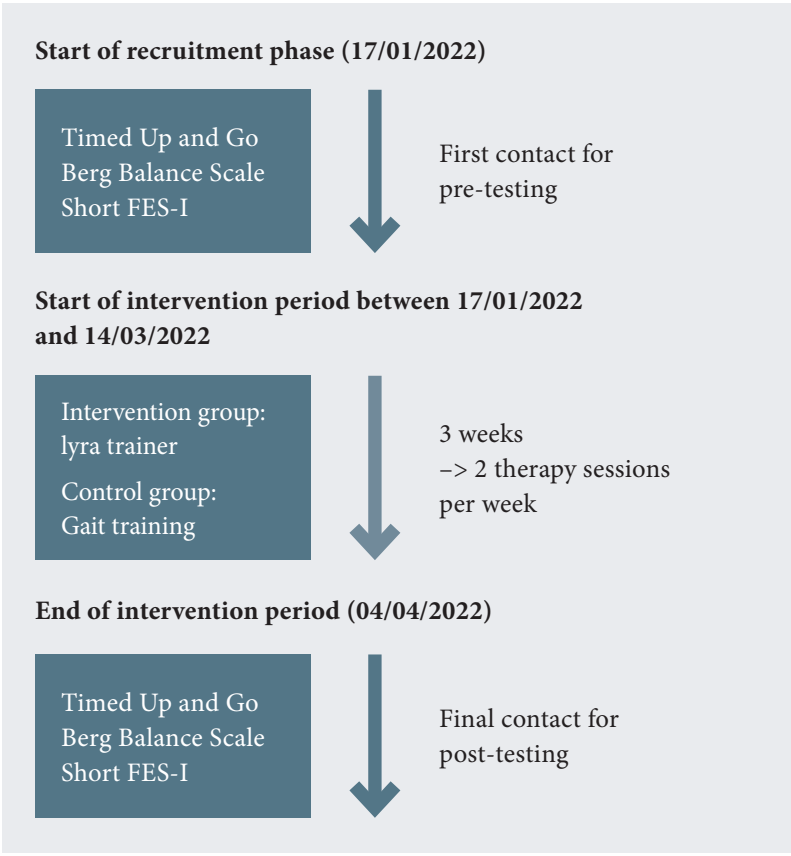


The psychosocial consequences of a fall mainly include a fear of further falls. This affects one-third of older people who fall. Aside from the consequences of a fall, this developing fear of falling also poses a risk factor for another fall, which can lead to restrictions in participation and activity, waning confidence in their own abilities and loneliness in the person affected.

Table 1. Patient characterisation

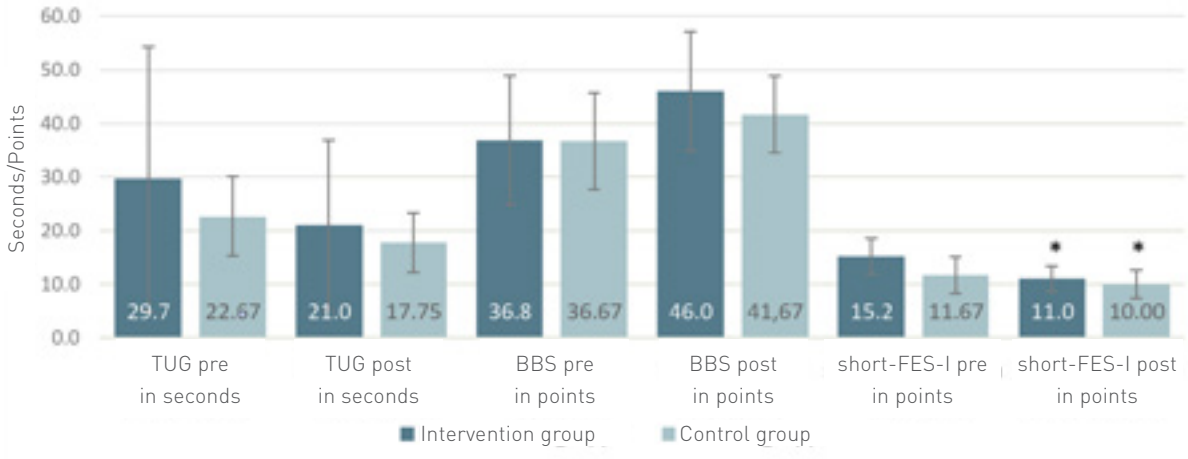
		Intervention group	Control group	Total
Number (n)		6	6	12
Gender (f/m)		(1/5)	(3/3)	(4/8)
Age (average years)		64.3 (±11.1)	73.7 (±9.3)	69 (±10.9)
Degree of rehabilitation (C/D)	Pre	(6/0)	(6/0)	(16/0)
	Post	(5/1)	(4/2)	(9/3)

Fig. 2: Intervention process



Chiara Winter, B.Sc. Physiotherapy – most recent position as an intern in the "Waldklinik Jesteburg" in the field of early neurological rehabilitation. Currently enrolled as a student at the University of Rostock in the Faculty of Human Medicine.

Fig. 3: Overview of averages of all assessments pre/post



Intensive Gait Rehabilitation

Sarah Daniel has challenged the perception of "traditional" rehabilitation with the implementation of technology and an evidence-based approach to intensive and high repetition training. In this expert interview, she shares her experience of using electromechanical assisted gait training and explains the advantages it has over conventional methods.

Sarah Daniel

Question: Sarah, thank you for sharing your experiences of using rehabilitation technology to help patients to recover from neurological disease. What prompted you to rethink outpatient rehabilitation in the UK and to start to integrate robotics as an integral part of what you do at MOTION Rehab?

Sarah Daniel: With the constant developments in acute medical care, there is a growing population of individuals living with disabilities after neurological injuries or disease. Patients are surviving longer and living with greater disabilities. Consequently, rehabilitation services are in demand, staffing resources are significantly under pressure here in the UK and I'm sure that's extrapolated across the globe.

Traditional approaches, of 'hands-on' therapy have high staffing requirements but low repetition and intensity. For example, if someone with a complex disability wants to learn to walk again, it may take between two to four clinicians (1) to enable them to take a few steps which is not sufficient to influence neuroplasticity, the re-wiring of the nervous system. In addition, it is not uncommon for rehabilitation to be time limited which further impacts on the ability for patients to achieve the high repetition and intensity required to maximise therapy outcomes and reach their potential. After reflecting on the research literature and evidence base, I concluded traditional

Sarah Daniel is the Owner and Founder of MOTIONrehab Limited. In 2018 Sarah opened the UK's first Intensive Robotic-Led Neurological Rehabilitation Centre. The unique innovation has challenged the perception of 'traditional' rehabilitation with the implementation of technology and an evidence-based approach to intensive and high repetition training. Her forward thinking, industry disruption and innovation has resulted in global invitations to speak at industry conferences, consult on clinic development worldwide and an international award.

Due to clinical demand Sarah opened a second facility, based in Hull in December 2020. Both clinics have international reference centre status for treatment, training, and research. In this expert interview, she shares her experience of using electromechanical assisted gait training and explains the advantages it has over conventional methods.

models of rehabilitation alone seemed inadequate and decided to re-think my clinical practice.

In 2017 during the conception of the clinic, I took inspiration from the Team at UCL London who had introduced an intensive upper limb programme, as well as visiting clinics across Europe who had already started to integrate Robotics and Rehabilitation Technologies into their clinical practice. The combination of these experiences resulted in the development of the MOTIONrehab concept which combines highly skilled 'hands-on' therapy with robotics and rehabilitation technologies.


Sarah Daniel

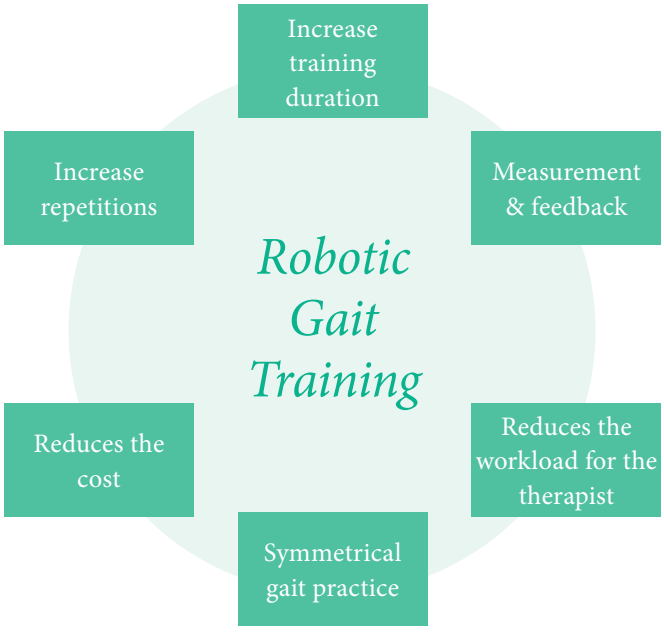
"We see a growing population of individuals with disabilities after neurological insult."

Question: You decided to use the THERA-Trainer lyra end effector gait trainer in your centre. What advantages does the device offer?

Sarah Daniel: The Lyra is an effective and efficient rehabilitation device for gait (walking) training. The LYRA provides body weight support which opens up the possibility of walking therapy for those people who are currently unable to walk or find walking difficult and can provide intensive training in a safe and effective environment.

The individual's feet held in place on mobile footplates driven by the robotic technology. The movement of the footplates replicates a natural walking pattern so that the patient can achieve high repetition of steps in a highly reproducible and consistent walking pattern.

By implementing the Lyra in our clinic, our patients can significantly increase the number of steps and the distance walked to provide controlled cardiovascular training and strengthening of muscles needed to improve their walking ability.



Watch video right here

https://l.ead.me/Sarah_Daniel_Robotic_Gait_Training_1

Question: How was the Lyra received by your therapists?

Sarah Daniel: Rehabilitating an individual's ability to walk is complex. Patients need to be supported to stand up against gravity and step from one leg to the other, which can be challenging when there is muscle weakness , loss of balance or other impairments caused by neurological injury/disease. Consequently, walking rehabilitation can be physically very demanding for clinicians as well as the patient.

The implementation of the Lyra Robotic Gait Trainer has reduced the physical burden on the clinical staff, as well as reducing the number of staff required to support the patient.

It is our experience that the body weight support system allows even patients with significant disabilities to get up and walking. The Lyra is quick and efficient to transfer into, generally only requiring the assistance of one staff member, so the patient can start training right away.

The design of the Lyra allows the MOTIOnrehab staff to facilitate movements to ensure the best possible walking patterns are achieved. The clinician are also able to measure speed, number of steps and distance walked, this helps with goal planning and tailoring treatment plans to the patient's individual needs. All the staff agree that the Lyra provides more efficient and effective therapy resulting in better outcomes for the patient.

Watch video right here

https://l.ead.me/Sarah_Daniel_Robotic_Gait_Training_2

"There is consistent evidence that increased frequency and intensity of gait therapy can improve recovery rates and outcomes."

"20% more patients are being able to walk compared to traditional therapy approaches."

Question: Does the scientific literature support the therapeutic approach you describe?

Sarah Daniel: There is high quality research evidence indicating that patients who receive electromechanical-assisted gait training, such as training on the Lyra, in combination with physiotherapy after stroke are more likely to achieve independent walking than people who receive gait training without these devices.

Research also shows improvements in walking speed and capacity if patients use a robotic gait trainer as part of their rehabilitation. Furthermore, studies have demonstrated improvements in global motor performances, walking endurance, balance and coordination, lower limb strength and even spasticity. Crucially, patients who have access to robotic gait training can achieve up to 20 times more repetitions during a therapy session, with some research indicating that as many as 20% more patients can walk independently when they have access to this therapy. However, the optimum amount of robotic gait training with regards to frequency, duration & timing of the therapy remains unclear. MOTIONrehab continue to support and work our colleagues in research and academia where possible to help contribute to the knowledge base.

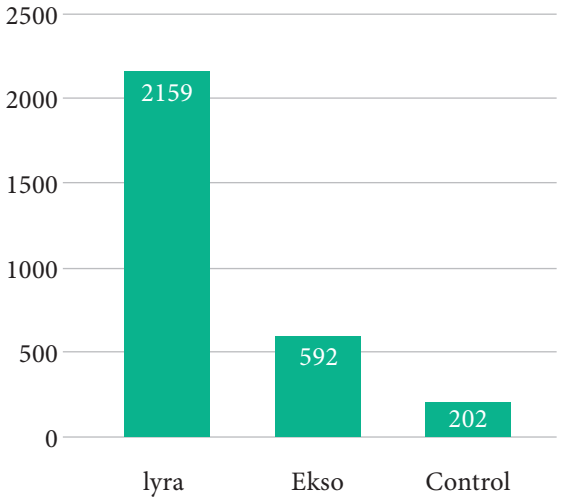
Watch video right here

https://l.ead.me/Sarah_Daniel_Robotic_Gait_Training_3

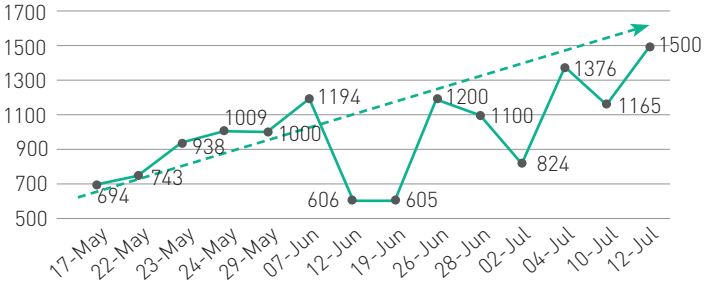
Question: What is your experience of using the Lyra look like in your practice?

Sarah Daniel: The implementation of the Lyra within the MOTIONrehab clinic has achieved some

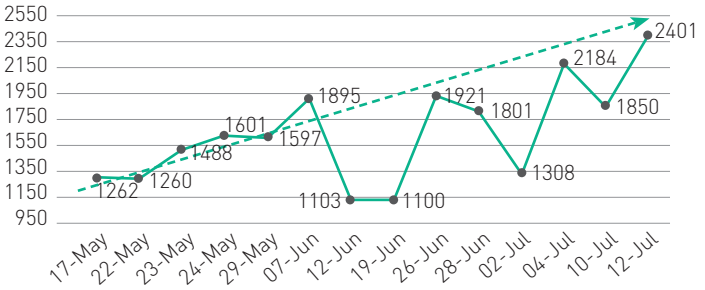
Average number of steps per Data obtained from Ekso Bionics and MOTIONrehab current clinic data



Distance (m)



Steps



really positive outcomes for our patients. Firstly, the patients express that they really enjoy the sessions and are highly motivated to train on the Lyra. For some of our patients it is their first opportunity to walk since the onset of their disability. It can be very emotional for the patient, family members and even staff. Research data indicates that patients in traditional therapy only achieve on avaerage 202 steps per session (1). If exoskeletons are implemented in gait training, the data suggests the average number of steps increases to 592 (2). We were therefore keen to assess the impact the Lyra had on repetitions of steps for our patients. A basic audit of the patients using the Lyra in the first year we were operational demonstrated the average number of steps was 2159, more than 10 times the number of steps compared to traditional therapy. One case study patient also demonstrated that over an 8-week period they were able to walk twice as far at the end of their therapy intervention compared to what they could achieve at the start of their treatment programme with MOTIONrehab. I am pleased to report this is not an isolated case! Our clinical data indicates patients are getting better quicker! Feedback from family and friends indicates that this is translating into being able to return to everyday activities such as work, hobbies and socialising. For the team at MOTIONrehab this is really positive because helping people to be able to return to the things they enjoy doing is the essence of rehabilitation.

Question: Thank you Sarah, for this brief introduction and experience snapshot.

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2. Tyson SF, Woodward-Nutt K, Plant S. How are balance and mobility problems after stroke treated in England? An observational study of the content, dose and context of physiotherapy. Clin Rehabil. 2018 Aug;32(8):1145-1152. doi: 10.1177/0269215518777789. Epub 2018 Jun 1. PMID: 29852758. Jun 1. PMID: 29852758.

TECHNOLOGY & DEVELOPMENT

The power of music

THERA-Trainer and JYMMiN are subtly declaring war on dementia, Parkinson's disease and stroke with a new music feedback app for mobility training.

Jakob Tiebel

Age-related brain diseases such as dementia, Parkinson's disease and stroke are on the rise due to demographic changes. Regular movement therapy is essential for people with neurological diseases to regain and promote mobility and independence. Neuroscientific findings have long proven that, to promote the regeneration and reformation of nerve connections in the brain, training needs to be as intense as possible and movements repeated frequently. To achieve this, therapists are increasingly turning to the power of music.

"Rhythms and sounds are anchored astonishingly deep within the human brain," explains neuroscientist Prof. Dr Thomas Fritz from Leipzig's Max Planck Institute for Cognitive Sciences. He and his working

group have intensively researched the impact of music on exercise and physical exertion and transferred their findings to practice. Leipzig start-up JYMMiN, which Fritz is involved in, converts physical exercise into music. Sensitive sensors on exercise equipment such as that found in fitness centres can convert the training into harmonious rhythms and melodies.

In future, this fitness method from the heart of Saxony should also be able to evoke special feelings of joy during therapy for patients with neurological diseases. In cooperation with THERA-Trainer, it has succeeded in making the invention useful for rehabilitation. From now on, even people unable to walk, who are sitting in a wheelchair, can create a wide variation of sounds using cyclic arm and leg movements on a THERA-Trainer. The newly developed THERA-music composition software processes the sensor data of the rehabilitation devices into individual accompanying music for this purpose.

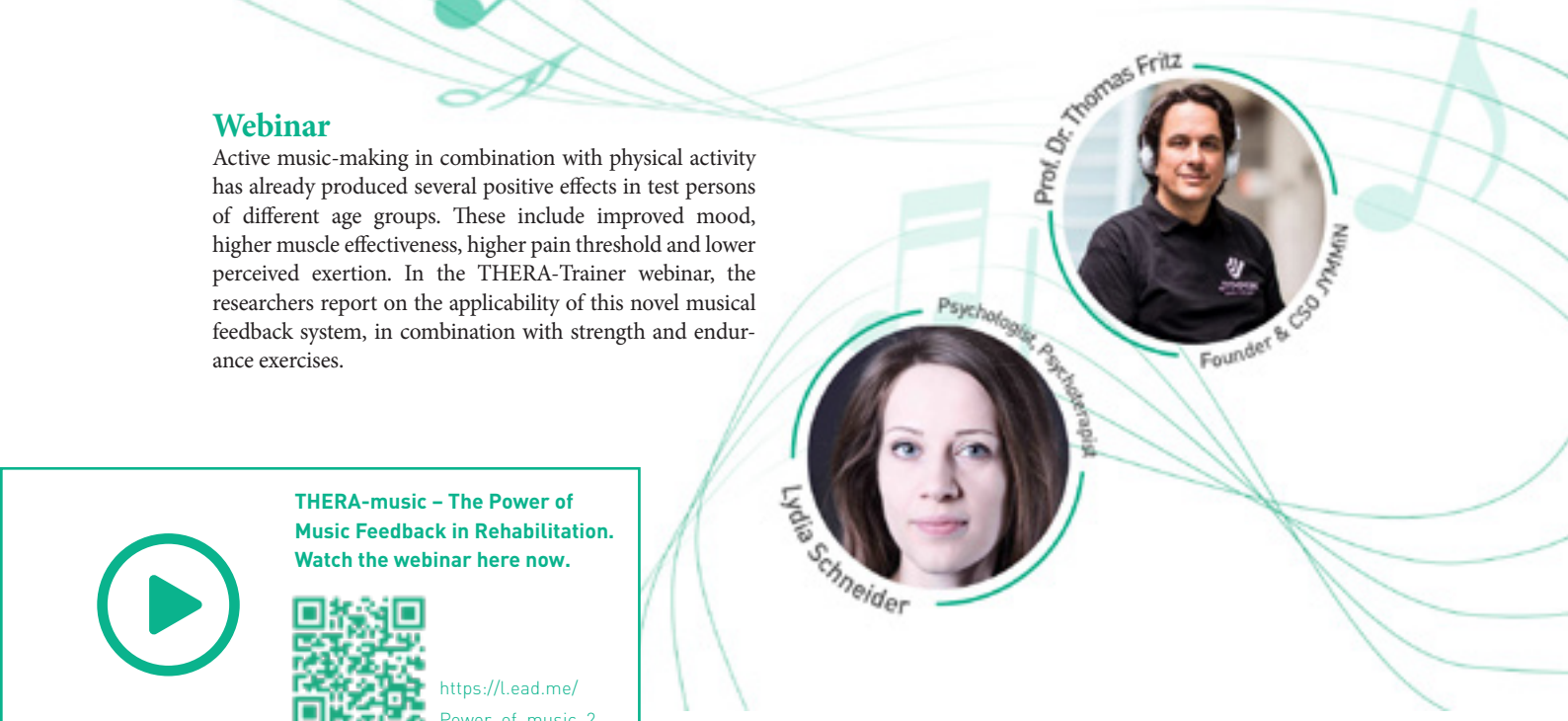
Especially in rehabilitation, this enables more effective training, as the patients reach their pain threshold at a later stage, Fritz explains. The combination of physical exertion and making music seems to stimulate the endorphin system. As a result, patients perceive the training as more enjoyable and less strenuous. Researchers and developers are right to call this a world first, as there are no other comparable systems yet available for rehabilitation.

Watch video right here

https://l.ead.me/Power_of_music_1

Webinar

Active music-making in combination with physical activity has already produced several positive effects in test persons of different age groups. These include improved mood, higher muscle effectiveness, higher pain threshold and lower perceived exertion. In the THERA-Trainer webinar, the researchers report on the applicability of this novel musical feedback system, in combination with strength and endurance exercises.



THERA-music – The Power of Music Feedback in Rehabilitation. Watch the webinar here now.

https://l.ead.me/Power_of_music_2

Early mobility matters

Early mobilisation in the intensive care unit is aimed at improving the outcome for the patient, and is increasingly becoming a required standard of care. In the middle of this year, THERA-Trainer launched a large-scale awareness campaign to inform about the opportunities and possibilities of effective early mobilisation in the intensive care unit.

Jakob Tiebel

Longer-term intensive care is associated with significant complications. If, for example, patients are mobilised too late after a stroke, heart attack or serious infection, the risk of permanent loss of mobility increases. "Longer-term immobility is harmful, as a decrease in muscle mass and bone mineral density along with impairment to vital physical functions can already be observed within the first week in the intensive care unit," explains physiotherapist and expert in early mobilisation, Tobias Giebler, of University Hospital Tübingen. "Patients decondition, which goes hand in hand with significant losses in function, reduced quality of life and higher mortality."

Clinical research suggests that early mobilisation reduces the development of weakness acquired through intensive care. "Patients are mobilised and taken out of bed as early as possible. This reduces the risks and helps patients maintain and improve their physical condition," says Giebler.

"Longer immobility is harmful, as a decrease in muscle mass and bone mineral density along with impairment to vital physical functions can already be observed within the first week in the intensive care unit."

"Our recipe for success for use in severely affected patients in the intensive care unit is the combination of safety, easy handling and variable use."

Early mobilisation saves resources and is proven to benefit patients

Early mobilisation can reduce the length of stay of patients in intensive care units by an average of two days. This not only saves considerable resources, but is also proven to benefit patients in a major way. Their recovery is accelerated and they find their way back to a self-determined life much more often and faster. **This aligns with the overarching goal of clinics to offer patients high-quality care, despite a shortage of resources.** However, the practice of early mobilisation is not yet widespread due to barriers in the clinical setting. Knowing about the barriers and identifying suitable strategies on overcoming them can help to make the concept an integral part of the daily routine. "The success of early mobilisation demonstrates the commitment and competence of the interdisciplinary treatment team," confirms Giebler. "Awareness of the problem is needed, along with suitable solutions for implementation."

Creating awareness of the problem and identifying practical solutions for implementation

With the newly launched "Early mobility matters" awareness campaign, THERA-Trainer is informing health professionals around the world through social media, expert journals and congresses about the advantages of early mobilisation and introducing solutions for implementation from their own technology portfolio. "Our recipe for success for use in severely affected patients in the intensive care unit is the combination of safety, easy handling and variable use," explains THERA-Trainer CTO Otto Höbel. The ideal product, the THERA-Trainer bemo, is a bed bicycle specially developed for early mobilisation. This means that patients can already be mobilised while lying down in the intensive care unit, before they are able to leave their bed. "The bed bicycle is clinically tested and is linked to a much lower duration of mechanical ventilation, length of stay in the intensive care unit and the occurrence of debility."

Find out more on the topic here.
https://l.ead.me/Early_mobility_matters

THERAPY & PRACTICE

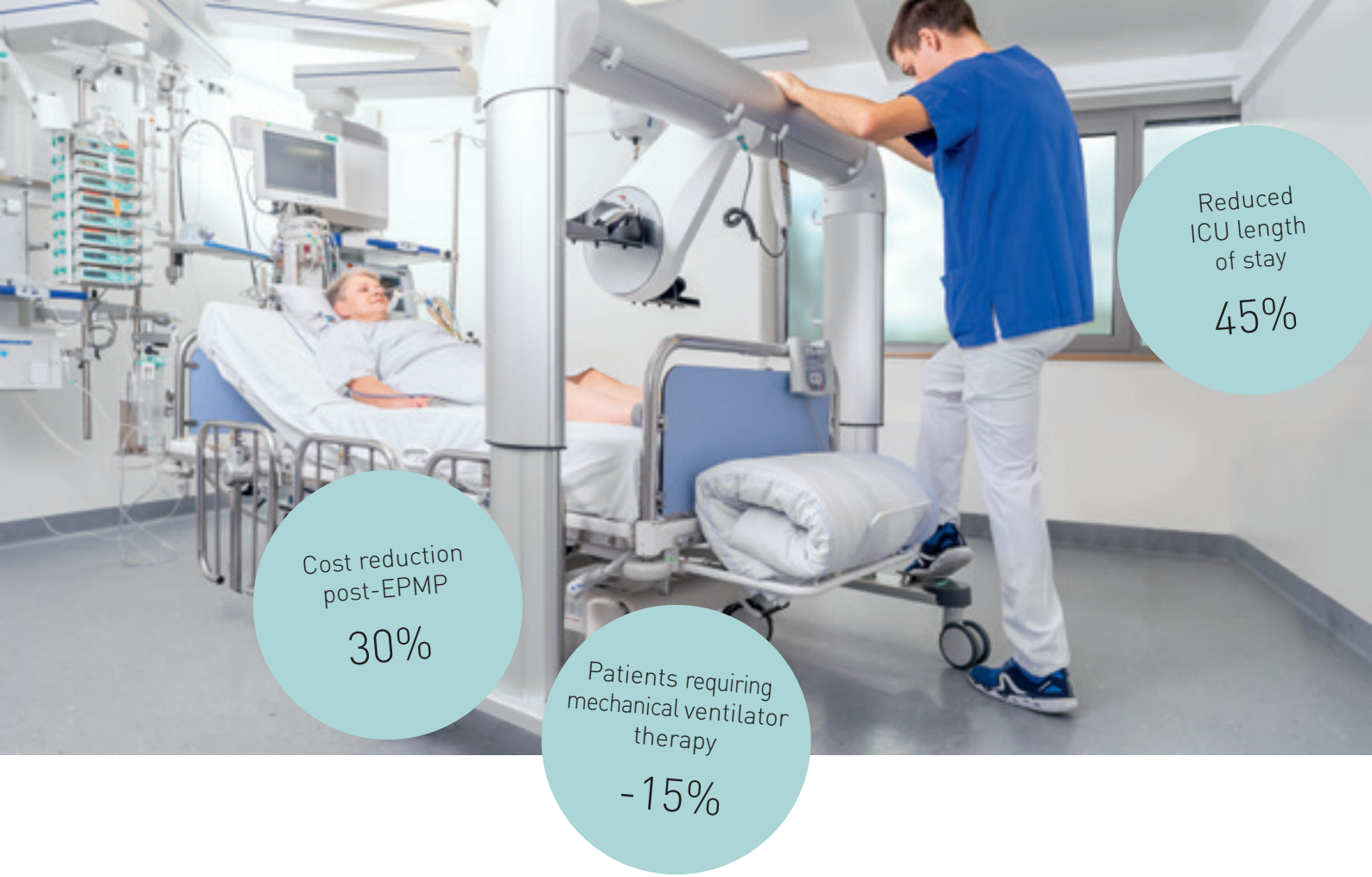
Early mobilisation in the intensive care unit

Effects of early mobilisation on the costs of neurological intensive care units

Jakob Tiebel

Early mobilisation protocols (EMP) for patients can significantly reduce length of stay in medical intensive care units and hospitals. Alongside an improved clinical outcome, there are also discussions around financial advantages, which mean that corresponding measures pay for themselves.

As part of a prospective pre-post comparison study, Klein and colleagues of the Cleveland Clinic Foundation investigated the impacts of an early progressive mobilisation protocol (EPMP) on the costs of a neurological intensive care unit. For the study, researchers recruited adult patients who were being



treated at a neurological intensive care unit with 22 beds. Alongside demographic data on the patient, the data collected included medical history, the degree of severity of the illness, mobility restrictions before the hospital stay (walking aids, physical restrictions), use of ventilators, the duration and reintubation, and direct, indirect and overall hospital costs. 637 patients on the neurological intensive care unit met the inclusion criteria. The average age was 62 (+/- 16) years. The APACHE III score for the severity of the illness was 57 points (+/- 27), indicating an illness of moderate severity.

The percentage of patients requiring mechanical breathing assistance was lowered by the use of an early progressive mobilisation protocol by 15% (before EPMP, 48.5% and after EPMP, 33.7%, $p < 0.001$), and the number of days on ventilation was reduced by 51% (before EPMP, 3.5 days compared to 1.5 days after EPMP, $p < 0.001$).

The cost analysis data included 605 individual hospital stays (30 had several stays on the neurological intensive care unit and no cost data was available for 2), meaning 603 cases were analysed (before EPMP, n = 221 and after the EPMP, n = 382). After adjustment for the demographic baseline data of the patients, which was different between groups (walking aid and gait disorder), the average direct, indirect and overall costs post EPMP fell by 30% (+/- 1%) compared to pre EPMP ($p < 0.001$).

The introduction of an EPMP in the neurological intensive care unit led to a reduction in overall hospital costs. The verifiable cost savings can be used to purchase safe patient handling equipment to improve the safety of caregivers, therapists and patients. The results increase the transparency of decisions on the allocation of funds for the introduction of early mobilisation protocols and help to make the underlying decision criteria explicit.

ORIGINAL WORK
https://www.atsjournals.org/doi/epdf/10.1164/ajrccm-conference.2015.191.1_MeetingAbstracts.A2293

Movement is medicine, or in other words: lack of exercise kills.

Sufficient exercise is essential for a healthy life.
All experts around the world agree.

Lars Timm

This not only goes for healthy people, but especially for groups of people whose physical performance and health are already under strain due to illness.

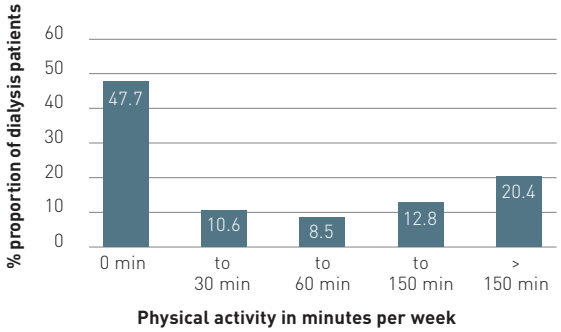
Despite this, one in three women and one in four men worldwide already do far too little exercise and do not meet the WHO's minimum requirements for physical activity (PA). This rising trend is leading to an increase in "diseases of affluence", which can be directly attributed to lack of exercise. These include diseases such as diabetes, obesity, cardiovascular diseases and psychological complaints.

Lack of exercise among dialysis patients

The lack of exercise and its effects are even more drastic in haemodialysis patients. They are mostly immobilised on the treatment couch for an average of 600–1,000 hours per year. As a result, this group of patients faces an especially high risk of concomitant diseases.

Despite the clearly proven effectiveness of PA among dialysis patients, experience reports from the past 30 years show that many patients are unable to participate in exercise programmes conducted during dialysis-free days. According to a study published in Germany in 2018, 47.7% of 240 dialysis patients surveyed reported the duration of their weekly PA as 0 minutes (Fig. 1). The reasons for this range from fatigue to a lack of suitable exercise groups and exercise equipment.

Figure 1 (Source 1)



Almost 48% of patients do not perform any physical activity, even though every person should actually be performing a minimum of 150 minutes a week.

But how is a patient who is already weakened by the multiple-times-a-week treatment supposed to be able to achieve a healthy level of PA if even the healthy population is falling short of these requirements?

The solution is "exercise during dialysis"

Why not combine the necessary with the useful and use the time on the treatment couch as exercise time?

Experts assume that almost all patients, regardless of age or concomitant diseases, can be integrated into exercise programmes or sports therapy measures during dialysis treatment (Source 5). Based on this assumption, numerous training programmes have already been developed, with the highest effectiveness shown in a combination of

endurance and strength training. In these training programmes, optimal training control is essential to avoid overload and underload.

In-bed exercise equipment such as the THERA-Trainer bemo can help here to provide patients with the training intensity to suit them, regardless of their performance capacity. In addition, it relieves the burden on nursing staff in the facilities, as the patient can perform the exercise independently without supervision.

Activity level and quality of life are directly related

"There is so much that exercise can do." And it doesn't always have to be a marathon or the Tour de France. **In general, it can be said that more exercise also leads to an improved quality of life.** Nevertheless, even a small amount of exercise can have a positive impact on quality of life.

Especially for patients who exercise during dialysis, this positive effect goes far beyond the prevention of "diseases of affluence". Several studies have shown that exercise during treatment reduces the risk of falls, increases heart rate variability and reduces arterial stiffness. In addition, exercise also has a direct positive influence on the effectiveness of dialysis, with increased urea and phosphate elimination (Source 2).

Psychological factors can also be directly influenced positively by PA. Results of American studies indicate that dialysis patients have an 84% higher risk of suicide than the general population and that depression is significantly more common. Exercise can help to counteract these depressions and anxieties and increase mental well-being. (Source 3)

A win-win, not just for the patient but also for the dialysis facility

In mostly profit-oriented health systems, the implementation of such a proven effective therapeutic approach often fails due to doubts about profitability. What at first sounds like additional personnel and financial expenditure turns out to be quite profitable. For example, training during dialysis can reduce the risk of falling or mitigate the consequences of falling, leading to a reduction in the hospitalisation rate, which experience shows to be around 10%.

Effects of PA on physical and psychological factors [based on source 4]

Initial conservative calculations show that training with the THERA-Trainer bemo can reduce the hospitalisation rate and the associated dialysis treatment failure from ten to nine per cent. For a facility with 100 treatments per week, this already means an additional turnover of about 25,000 euros per year.

In addition, new customers can be better recruited with the additional training offer in the highly competitive market.

Lars Timm Studied Sports Science with a focus on rehabilitation in Freiburg i.Br. and M.Sc. Sports Engineering at KIT Karlsruhe.

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SCIENCE

Mobility training with ALS

Usage and subjective experience of the effect of motor-supported movement exercisers among people with amyotrophic lateral sclerosis. Results of a multi-centric observational study.

Jakob Tiebel

The importance of defining patient-reported outcomes (PROs) is growing for clinical practice in neurorehabilitation and care research. PROs provide reports from patients on their own health status, quality of life and functional status in relation to medical care and treatment. Special tools and instruments known as patient-reported outcome measures (PROMs) and patient-reported experience measures (PREMs) are used for measurement.

Maier and colleagues from the Centre for Amyotrophic Lateral Sclerosis (ALS) at Charité - Universitätsmedizin Berlin and Ambulanzpartner, the platform for care and research in rare neurological diseases, investigated the effect of additional assistive mobility training in patients with ALS in a recently published study. Here, researchers used PROMs and PREMs to capture subjective experiences of the therapy and how likely users were to recommend it.

The results, which were published in Nature Scientific Reports, show that ALS patients benefit greatly from assistive mobility training. For this purpose, data from 144 participants was analysed. 41% of participants used the movement exerciser 1 to 4 times per week, 42% 5 to 7 times and 17% more than

The study:
https://l.ead.me/
Mobility_training_with_ALS

7 times per week. Particularly positive results were recorded in the following areas: increase in sense of accomplishment (67%), reduction in the feeling of having stiff limbs (63%), reduction in feeling of being immobile (61%), improvement in general well-being (55%) and reduction in muscle stiffness (52%). Participants with pronounced muscle weakness were more likely to report that mobility training had a positive effect on maintaining and improving their muscle power ($p < 0.05$). Most patients stated that they had achieved their individual therapy goals, which was reflected in a high level of satisfaction. The recommendation rate was high. 71.6% of patients (n = 101) strongly recommended the training.

The PREMs also provided indications that training was associated with a resolution of perceived inactivity. A main advantageous feature of mobility training in this context is the integration of passive and assistive exercises, made possible thanks to motor support. Due to the severity and progression of symptoms in ALS, participation in a purely active exercise programme would probably not have been possible for most participants in the study. In view of this fact, the movement trainer gains in value and importance for the therapy. The intervention therefore differs significantly from conventional home training programmes.

Although the movement exerciser is a medically indicated device, it is not yet regularly given to ALS patients. Further research is needed to clarify what exactly the barriers are to early therapeutic implementation and more consistent care. However, it is clear that the movement exerciser contributes to a demonstrable improvement in the quality of life with ALS and deserves more attention in the context of standard care in future. The results of the study support the justification of extended therapy as part of a holistic treatment approach for ALS.

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SmartHealthNet

A digital care algorithm for patients, doctors, caregivers and therapists.

Jakob Tiebel

SmartHealthNet is a research project that brings together medical services, technical aids and all players involved in the care of neurological patients with digital support. The goal: individual, needs-based and coordinated care management of the people concerned.

In Germany alone, around 190,000 people suffer a stroke every year. 30 per cent of those affected experience a permanent disability. These people require medical treatment, physiotherapy and occupational therapy, speech therapy, special aids and social services. Unfortunately for patients, care processes are often very fragmented, inefficient and not very reproducible.

SmartHealthNet could change this situation in future. The aim of the project is to develop a service system that includes medical and digital services, rehabilitation technology and a digital management platform. This is intended to create a multi-faceted benefit, where doctors, providers and therapists receive more precise information and those affected receive personalised care.

"The algorithm is primarily based on data generated by the patient themselves."

Tom Kramer

"Care suggestions coming from the patient's self-assessment help to make care in the assistive device field quicker and more suitable for requirements."

Anja Weiss

SmartHealthNet is a federally funded research project. The model is intended to contribute to the future of medical care and can be applied to the care of many neurological diseases such as stroke, multiple sclerosis and amyotrophic lateral sclerosis.

The Berlin-based company Ambulanzpartner is the main initiator of the project. The sociotechnology service provider has been working for several years on a holistic concept for the care, research and networking of patients with rare, severe neurological diseases. The care algorithm developed as part of SmartHealthNet is intended to further improve the holistic concept in future.

The care algorithm developed as part of SmartHealthNet is primarily based on data that the patient generates themselves during care in the form of patient reported outcomes (PROMs). As presented in the article "Mobility training with ALS", the care concept of Ambulanzpartner already takes into account the ability of patients to evaluate their health status and the care situation on the basis of patient-reported outcome measures (PROMS) and patient-reported experience measures (PREMS). To do this, they take part in surveys and enter the corresponding data into an app during the process.

The key advantage of the care algorithm is that the data patients generate via the PROMs has a direct impact on their care. Care suggestions resulting from entries in the app then directly contribute to the fact that, for example, care with an aid, such as the movement exerciser, can be carried out more quickly and in line with requirements.

"I hope that through the care algorithm, we can improve the care of ALS patients in Germany, Europe and around the world in a few years' time."

Prof. Dr Christoph Münch

Co-Founder and CEO Ambulanzpartner

"Initial experiences of use have been promising because the care algorithm gave suggestions on what aspects of care I can talk about with the patient."

Dr med. André Maier

Further potential lies in the linking of different data sources. For example, THERA-Trainer included data generated during training on the therapeutic movement exerciser in the algorithm during the project. In this way, PROMs can be supplemented in future with progress profiles and training data that the patient generates directly through the use of their assistive device.

So far, the care algorithm is still a research project and, for the time being, still pioneering work by Ambulanzpartner and participating consortium partners. In the long term, however, there is the potential to improve the care of neurological patients in Germany, Europe and worldwide through the use of this innovative approach.

CARE ALGORITHM SMARTHEALTHNET

https://l.ead.me/SmartHealthNet

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"Readings from the app can provide important information on the course and dynamics of the ALS disease."

Susanne Spittel

smarthealthnet.

SmartHealthNet –
Conception, development and piloting of data-based case management

www.smarthealthnet.de

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Bundesministerium für Bildung und Forschung

Music feedback improves physical endurance among older patients

Music can do more than improve your mood and regulate emotions. It also influences the physical performance of human beings.

Prof. Thomas Fritz, Jakob Tiebel

Studies on the effects of music feedback show that actively making music in connection with physical activity can evoke positive effects for various age groups. Researchers have now found that older people can exercise even longer with the same sense of exertion if their physical exercise is supported by active music-making. It is an effect that could be of great benefit for maintaining mobility in our aging society in future.

Actively making music in connection with physical activity has several positive effects on people of different age groups. These include improved mood, higher muscle effectiveness, a lower pain threshold and lower perceived exertion. In a new study, a group of researchers led by Kathrin Rehfeld from the Institute for Sport Science at Otto von Guericke University in Magdeburg and Professor Thomas Fritz from the Department of Neurology at the Max Planck Institute for Human Cognitive and Brain Sciences in Leipzig investigated the applicability of a music feedback system

in combination with strength endurance exercises among older adults.

Researchers recruited sixteen healthy, physically inactive older adults (5 men, 11 women) with an average age of 70 years for the study. They performed physical exercises under two conditions: conventional training with passive music listening and interventional training in which the subjects could produce musical sounds through their training movements. According to the hypothesis that strength endurance is increased during training with music feedback, parameters related to strength endurance were investigated. These included training duration, number of repetitions, perceived exertion (RPE) and the participants' mental state (Multidimensional Mood State Questionnaire; MDMQ).

The researchers published their results in the journal Frontiers in Sports and Active Living. Participants in the intervention group trained significantly longer (Mdn = 248.75 s) when actively making music during exercise than during conventional training (Mdn = 182.73 s), ($Z = 3.408$, $p = 0.001$). However, perceived exertion (RPE) did not differ between groups (Mdn = 14.50; $Z = -0.905$; $p = 0.366$). It can therefore be assumed that the participants were able to train longer with the same feeling of exertion. Training with music feedback also promoted a higher level of isometric contractions (muscle actively held at a fixed length) and a less stereotyped contraction pattern. The researchers suspect that the less stereotypical contraction pattern during the music feedback training improved the endurance of the participants, as the subjects were able to better allocate their energy reserves during the training (pacing).

Due to the positive effects on the activity level of older people, music feedback could play an important role in the field of senior sports and exercise therapy for older people in future.

Virtual Reality Rehabilitation

The future of physical therapy.

Jakob Tiebel

What comes to mind when thinking about traditional physical therapy? It is often boring! It is repetitive by nature, and these repetitions decrease patient motivation experience and engagement over time. In addition, the traditional setting requires at least one therapist to work 1:1 with the patient, which increases the need for resources and thus the cost to the healthcare system. It also does not provide objective data and does not offer a way to monitor the intensity and specificity of the therapy that patients engage in. Researchers are therefore looking for new methods to improve motor rehabilitation and make it more attractive and effective. Virtual reality (VR) has recently emerged as a useful adjunct to conventional therapy by incorporating rehabilitation strategies into a novel yet effective approach. VR-assisted therapy has been shown to provide a positive learning experience and to be engaging and motivating. In a recent online event, three experts shared their experiences of using VR Rehabilitation Technology in combination with THERA-Trainer. Participants gained insight into the possibilities of this new technology in the context of physical rehabilitation.

Efficacy of Virtual Reality for Neurological Rehabilitation

Veena Somareddy, founder and CEO of Neuro Rehab VR, gave an insight and overview of virtual reality applications in healthcare and a deeper understanding of their use in neurological rehabilitation. She explained how Neuro Rehab VR harnesses the neuroplasticity of the brain through immersive 3D environments with precise control over the stimulus and cognitive load experienced by the user. She went on to discuss how setting functional goals in VR therapy exercises can increase patient engagement, how patient progress reports with quantitative data can help support recovery, the psychological impact virtual reality therapy has on patients. This impressively highlighted the overall efficiency that underlies the use of VR during therapy.

360° VR bike rides to help the recovery of semi-critically ill patients during rehabilitation sessions

Mariella Pisciotta, Co-founder of Reality Telling showcased, how 360° VR bike rides can help semi-critically ill patients to recover from ICU Aquired Weakness. Reality Telling produces 360˚ video rides selecting iconic Barcelona areas to engage and motivate patients during in-bed cycling training with THERA-Trainer bemo at Hospital del Mar Barcelona. The application of this experiences through VR glasses has shown great results in terms of patients' motivation, hence better performance, and faster recovery. The Immersive experiences are now part of the humanization program of the Intensive Care in the Hospital del Mar in Barcelona.

A growing elderly population – and the problem with viewing them as a diagnosis

Steen Petersen, CTO of Syncsende addressed the issue of demographic change. Syncsense is a life-enhancing digital training technology for physical and cognitive VR training of society's most debilitated and inactive elderly and people with disabilities. The VR solution transforms training equipment (e.g. for cycling, balance and gait) into sensory stimulating and socially engaging training experiences - and promotes physical, cognitive and social activity. As the population of elderly citizens grows but the number of warm hands to treat them decreases, a squeeze is being felt already now that is only getting worse. This is what Syncsense aims to ameliorate. And VR is one of the ways the company have found to start working on it.

https://l.ead.me/Virtual_Reality_Rehabilitation_Veena

Veena Somareddy CEO Neuro Rehab VR
Veena Somareddy is the CEO of Neuro Rehab VR, a VR healthcare start-up aimed at building virtual reality therapy exercises for physical therapy. Her accolades include being recognized as a Top Innovator in North Texas, Fast Company's World Changing Ideas honoree, and featured in Forbes and Cosmopolitan. She is also the recipient of a National Science Foundation grant and one of the 10 start-ups chosen to participate in the first Amazon Healthcare Accelerator. Using her many years of research and development experience in VR and AR she is helping to connect technology and healthcare to enhance patient care and rehabilitation outcomes greatly. She earned a B.S. in Computer Science and a Master's in Game Design and Development from UT Dallas and was pursuing her Ph.D. before she decided to work on the company full-time.

https://l.ead.me/Virtual_Reality_Rehabilitation_Mariella

Mariella Pisciotta Co-founder Reality Telling
Mariella Pisciotta has a Bachelor's degree in International Economics, a Master's degree in Formulation and Management of Development Cooperation Projects and graduated the PMD IESE Business School. She has over 20 years of experience in fundraising, management and administration of social projects.

https://l.ead.me/Virtual_Reality_Rehabilitation_Steen

Steen Petersen CTO SYNCSENSE®
Steen Petersen has spent a decade working as a physical therapist in three different countries, Portugal, Holland and Denmark. He has a bachelors in physical therapy from Amsterdam Univeristy and a Master in Medicine and technology from the University of Copenhagen. Coming from a family of engineers Steen has always tinkered with technology and has been a software developer for 6 years. It was the experiences of social isolation, immobilization and under-stimulation that he witnessed patients exposed to in hospitals and nursing homes as a physical therapist that drove him to found Syncsense.

TECHNOLOGY & DEVELOPMENT

Virtual training for people with dementia

Jakob Tiebel

Virtual reality could help to promote movement and evoke positive feelings in dementia patients in future. As part of the research and development project "VR4 Mind & Motion", dementia patients train their mobility and memory using 360-degree videos. This unique project was launched by AAL AUSTRIA, the innovation platform for intelligent assistance in everyday life. As sponsorship partners, THERA-Trainer provides the ergometers for mobility training, Netural develops the VR software and Volkshilfe makes it possible to conduct the study and provides the participants accordingly.

The rising life expectancy in our society will require solutions for mobility in all situations and independence into old age. The demographic trend and the aging population are also accompanied by age-related diseases such as dementia. Global statistics show that around 50 million people were suffering from some form of dementia in 2017, and the number is rising. In 2030, the number is expected to reach 75 million, and in 2050, around 130 million.

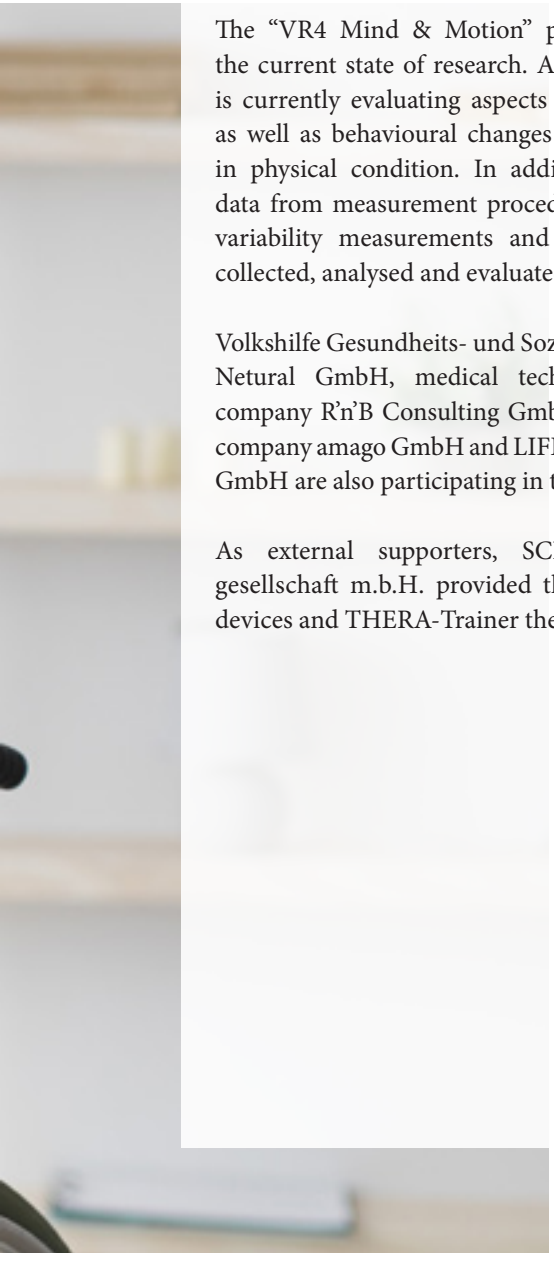
Dementia is the general umbrella term for pathological changes in the brain that are mostly age-related. The disease is characterised by a progressive loss of mental functions such as thinking, orientation and learning ability. In connection with this, emotional and social skills also decrease in the course of the disease.

The AAL AUSTRIA working group looks at the challenges associated with the disease from different perspectives. New information and communication technologies enable completely new concepts for coping with the demands on the health system and to preserve quality of life high even in old age. The use of virtual reality also plays a role here.

The aim of the project "VR4 Mind & Motion" is to develop a VR-based training system for people with dementia. This opens a digital window into the virtual world for those affected. The basic idea is that those affected experience a forest or meadow landscape during physical activity on the ergometer, for example, using 360° video recordings. The focus is on evoking positive feelings. The dementia patients should relax and at the same time be motivated to be physically active. In this way, conventional therapy approaches could be expanded in the future and the burden on caregivers and relatives reduced.

From a research perspective, the technology has the potential to significantly improve the quality of life of people with dementia. Immersion in a virtual world can bring back memories from the past, reduce anxiety and improve social interaction with caregivers and relatives.

Some research already exists that deals with the use of virtual reality in dementia. A literature review by Garcia-Betances et al. (2014), for example, explores how virtual reality affects older people and how technology can support family members and caregivers in terms of improving quality of life. A further review by Garcia-Betances et al. (2015) deals with the different types of virtual reality and their possible applications for diagnostic and therapeutic purposes. The results show that VR applications can support cognitive training in older people with dementia. A 2016 research project at Aalborg University in Denmark also showed that virtual reality technologies could motivate female residents in care facilities to exercise more (Jon Ram Bruun-Pedersen et al. 2016).



The "VR4 Mind & Motion" project ties in with the current state of research. A pilot clinical study is currently evaluating aspects of user satisfaction as well as behavioural changes and improvements in physical condition. In addition to interviews, data from measurement procedures, such as heart variability measurements and cognitive tests, is collected, analysed and evaluated for this purpose.

Volkshilfe Gesundheits- und Soziale Dienste GmbH, Netural GmbH, medical technology consulting company R'n'B Consulting GmbH, film production company amago GmbH and LIFEtool gemeinnützige GmbH are also participating in the pilot project.

As external supporters, SCHILLER Handelsgesellschaft m.b.H. provided the HRV measuring devices and THERA-Trainer the ergometer.

CORRESPONDENCE ADDRESS:
Working group leader Uli Waibel, General secretary AAL AUSTRIA – Innovation platform for intelligent assistance in everyday life uli.waibel(at)aal.at

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Interview:

A first trial run with a total of 8 people from the Volkshilfe Regenbogen dementia day centre in Linz, Austria has already been successfully completed. Participants first explored a 360-degree mountain landscape without any physical activity. What insights did you gain from the preliminary study?

People seem very interested in the 360° videos and talk about their memories from the past or their home. Above all, you often hear stories about frequently visited places and hikes. [**Netural GmbH**]

"People seem very interested in the 360° videos"

Sebastian Mayer, Netural GmbH

To what extent do older people with dementia have reservations about immersing themselves in 360-degree environments via VR experiences?

At first glance, the new technology is something new for them, and they are quite sceptical about it to start with. However, we are noticing that many older people are curious about VR technology and also want to give it a try. A picture gallery or a video player is a good way to start. **[Netural GmbH]**

What influence does the mobility training have on the effects of the intervention?

Through the pilot study, we have already established that the test subjects can remember details from virtual reality even one week after our training combination of VR and ergometer. They mention objects (e.g. a swan) they have seen in a past VR video in the Nuremberg Age Inventory test (a test in which the participants have to remember pictures). Furthermore, we found that some people need a spoken guide to the virtual reality, but others dive directly into this world to explore it for themselves. The effects of the training will be determined after completion of the pilot study using questionnaires, evaluation of the HRV measurement, the NAI test and the 10-metre walking test. Suspected negative side effects such as dizziness, motion sickness or nausea did not occur at all in 9 participants with a training time of 20 minutes. **[R'n'B Consulting GmbH]**

"Some people need a spoken guide to the virtual reality"

Cornelia Hoflehner, R'n'B Consulting GmbH

"The physical training has positive effects on the cognitive abilities of the participants."

Sophie Müller-Wipperfürth,
Volkshilfe Gesundheits- und Soziale Dienste GmbH

The VR experience focuses on evoking positive feelings in dementia patients. What influence does this have on the experience and behaviour of these people?

Showing people places awakens memories of the past. The combination of VR and ergometer training for people with dementia shows that images and videos can awaken memories. They talk about their experiences, report on what they have experienced and can sometimes remember details. Especially places from their immediate surroundings awaken more memories and emotions and thus lead them to talk more about the past. **[Netural GmbH]**

What influence does physical exercise have on the cognitive and mental functions of older people with dementia?

The study shows that physical training has positive effects on the cognitive abilities of the participants. This is shown on the one hand by the fact that the test persons, who are regular visitors to the Volkshilfe Regenbogen day centre, already tell enthusiastic and extremely lively stories about their lives during the training, and on the other hand also by an increase in performance in cognitive tests, which are carried out before and after the training. However, an exact result regarding an increase in cognitive performance is still to be evaluated – after the clinical

study has been completed – by our investigator Dr Spinka and R'n'B Consulting GmbH. **[Volkshilfe Gesundheits- und Soziale Dienste GmbH]**

To what extent does the positive VR experience lead to an increase in training motivation?

The training support by means of VR technology manages to make the ergometer training exciting. Participants find themselves on a virtual journey through different areas such as lakeshores, country lanes, etc. On the one hand, this makes the training less one-dimensional, while on the other hand, it awakens various memories of earlier experiences and hiking or cycling trips among the participants. These positive associations are reflected in an increased motivation to exercise, as it was very easy for all test subjects to persevere for 20 minutes on the THERA-Trainer; in addition, all without exception were enthusiastic about the VR-supported experience. **[Volkshilfe Gesundheits- und Soziale Dienste GmbH]**

What are the chances of a nationwide implementation of VR-based training in dementia?

Whether VR is used in public institutions depends on several factors. On the one hand, everyone must be prepared to familiarise themselves with this new technology and be open to it. Caregiving staff or those providing support for its use need to get to grips with this matter and show interest in it. On the other hand, money plays an essential role. The purchase cost of the headsets is not the only consideration when incorporating VR; the time required to support its use also comes at a cost and must be considered at the time of purchase. **[Netural GmbH]**

How modern rehabilitation technologies help to effectively prevent falls in older people

The THERA-Trainer fall prevention and balance program combines innovative rehabilitation technology with customized clinical exercise protocols specifically for this application. The article provides some basic information on fall prevention and presents solutions and user feedback from clinical practice.

Brenda Garcia-Tscherne

As therapists, we know that as people age and require more care, the risk factors for falls increase. Muscle strength, impaired vision, sleep problems and daytime fatigue, incontinence, and dizziness, as well as external factors like poor lighting or medications all influence the risk of falls.

The common consequences of falls can range from bruises to wounds and even serious fractures which can result in the significant loss of independence, need for long term assistance or even death. Regardless of the resulting pathologies, every fall contributes to the feeling of insecurity and fear of falling. Time and time again we see how this situation conduces to movement avoidance, leading to decreased strength and balance and lower quality of life (1). A vicious cycle of fear and avoidance behavior sets in.

The best way to prevent and counteract most of these fall risk factors is to maintain and promote mobility and do it early. The ability to stand and

work on balance is the starting point to work towards ambulation and therefore of utmost importance for all acute rehabilitation (2). The importance of getting patients back on their feet as early as possible and engaging in meaningful task specific activities is well documented in research. For example, a recent study demonstrated a statistically significant benefit in functional balance for individuals post stroke who engaged in sustained standing of 30 minutes, 5 days a week (3). The principles of neuroplasticity must be present to maximize neuroplasticity in standing: As stated by Klein and Jones, use it, or lose it, repetition, intensity, and time matters (4). Other benefits include stretching contracted muscles, decreasing spasticity, strengthening muscles, improving bladder and bowel function and relieving pressure areas (5,6,7). However, providing interventions that encourage these principles can be a challenge.

The THERA-Trainer fall prevention and balance program combines innovative rehabilitation technology with customized clinical exercise protocols specifically for this application. The patented THERA-Trainer balo and THERA-Trainer coro dynamic balance systems assist therapists to perform static and dynamic standing exercises to train anticipatory and reactive balance, as well as postural control, weight-bearing, weight-shifting, object pick-up, core strengthening and for fall prevention. Naomi Greenberg, Physical Therapy Team Leader at MossRehab, PA states: "We utilize the balo to assist patients with SCI to improve proprioception, strength and motor control of their trunk and core musculature. As a result, we are able to achieve a decreased fall risk when performing both sitting and standing tasks." The systems allow up to 11° of postural sway in all directions to effectively train patients' postural control in a fall-safe environment. A fast setup is key for therapists, balo and coro are designed for extremely quick and easy setups in typically under 3 minutes.

The THERA-soft therapy and documentation software allows for a variety of movement tasks and biofeedback activities to enhance repetition, intensity and motivate patients to train. It also adds the benefits of motor planning, visual scanning, and

dual tasking to the therapy session. An integrated database helps therapists with patient-specific training controls and planning of interventions as well as detailed analysis and evaluation of all training results.

Thanks to the use of technology, therapists can prioritize the use and interpretation of clinical outcomes in a fast and easy to access manner. "I recently had a patient with profound sensory and coordination deficits who was able to stand and ambulate with an assistive device but had trace ankle motor function and significant weakness in his gluts. The balo was the perfect tool to specifically target and activate these muscle groups, work safely to fatigue, and improve carryover to overground walking." as Kelsey R. Loose, Physical Therapist at MossRehab summarizes her experience with THERA-Trainer balo.

"The balo is unique because it is so dynamic. Other standing frames don't have the features that the balo has, which makes it stand out as a device. We can stand patients that we wouldn't normally be able to stand and get better outcomes at a quicker rate. This is a life-changing device."

Director of Rehabilitation Services about THERA-Trainer balo.

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